

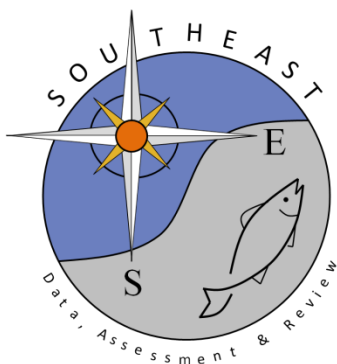
Estimation of scalloped and smooth hammerhead discards in the northeast gillnet fishery
using data collected by the NOAA Northeast Fisheries Observer Program

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SEDAR 77 DATA WORKSHOP DOCUMENT**Estimation of scalloped and smooth hammerhead discards in the northeast gillnet fishery using data collected by the NOAA Northeast Fisheries Observer Program**

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Summary

Dead and live discards of scalloped and smooth hammerhead sharks from the Northeast Region's Mid-Atlantic sink-gillnet fishing fleet were estimated in numbers and weight using data collected by the Northeast Fisheries Observer Program from 1995 to 2019 and were back-calculated to 1981. Block averaging of the discard rates was also used to create estimates in numbers and weight. Additionally, based on panel recommendations considering all bycatch data available for use during this assessment, discard estimates for the northeast gillnet fishery were created using the grand mean of the discard ratios.

Introduction

The Northeast Fisheries Science Center implemented an observer program in 1989 with the intent of developing estimates of discards for all species in the Northeast Region's fleets. Observers are deployed on commercial vessels in an effort to quantify bycatch and document protected species interactions. Within the gillnet fleet, vessels are selected based on the intended target species, mesh size used, and the likelihood of protected species interactions. Sampling priorities are determined by the funding source. This working paper focuses on the gillnet fleet. The majority of gillnet trips are single day trips with a gear configuration of anchored sink, drift sink, or drift floating gillnets and gillnet sets range from one to twenty per trip. Observers are tasked with collecting economic data, weather conditions, and gear characteristics, as well as, biological data for both the catch and bycatch. For shark bycatch, each fish is examined for status (alive, dead) when brought onboard, weight, length (fork length) sex, end status, and kept or discard status (and discard reason). Species specific shark identification was not consistent before 1995. This working paper develops ratio estimators from the Northeast Fisheries Observer Program data to apply to landings data for estimation of scalloped and smooth hammerhead shark discards from the Northeast Region's Mid-Atlantic sink-gillnet fishing fleet from 1995 to 2019.

Methods

Discards were estimated using ratio-estimators based on the methodology described in Rago et al. (2005) updated in Wigley et al (2007). The estimators rely on a ratio of discards to total species kept. Only sink gillnet trips that occurred during the second through four quarters (January –March, April-June, July-September, October-December) and within coastal mid-Atlantic waters (Figure 1) were used to develop discard estimates for the Northeast Region's Mid-Atlantic sink-gillnet fishing fleet from 1995 to 2019. Mesh size was not used to split out sink gill net trips and all trips were included if they occurred within this stratification regardless of whether or not they caught scalloped or smooth hammerhead sharks. If fish status was unknown at haulback and unknown when discarded, then the fish was considered a dead discard. If the fish status was alive at haulback and unknown when discarded, then the fish was considered a live discard. For calculating total catch, all weights were converted to round live weight using the Commercial Fisheries Database System conversion factors.

The discard ratio (R_h) for sharks in stratum h (annual quarter) is the sum of discard number or weight (d_{ih}) for all observed trips (i) divided by the sum of total species kept weights (k_{ih}) for all observed trips:

$$R_h = \frac{\sum_{i=1}^{n_h} d_{ih}}{\sum_{i=1}^{n_h} k_{ih}}$$

The stratum discard estimate (D_h) is simply the product of the discard ratio R_h and the total species kept weight for the fishery (K_h) within that annual quarter, $D_h=R_hK_h$. Annual discard estimates (\hat{D}) are the sum across strata. The variance (V) for each annual discard estimate is defined as:

$$V = \sum_{h=1}^L K_h^2 \left(\frac{N_h - n_h}{n_h N_h} \right) \frac{1}{\left(\frac{\sum_{i=1}^{n_h} k_{ih}}{n_h} \right)^2} \left[\frac{\sum_{i=1}^{n_h} (d_{ih}^2 + R_h^2 k_{ih}^2 - 2R_h d_{ih} k_{ih})}{n_h - 1} \right]$$

Where N_h and n_h are the number of total trips and observed trips within stratum h , respectively. L represents the four strata (quarters) within a year. The coefficient of variation (CV) for each annual discard estimate (\hat{D}) is defined as:

$$CV = \frac{\sqrt{V}}{\hat{D}}$$

To back-calculate the discards to 1981, the average discard ratio across all strata (grand mean) for live and dead discards by number and weight were applied to the annual total landings for the Mid-Atlantic statistical areas identified in Figure 1 from the dealer database. Not all Mid-Atlantic states reported until 1989; therefore, the estimates before this time are likely underestimated.

Multi-year block averaging of the discard ratios was used to improve the discard estimate trend by reducing variability and providing estimates for years with zero discards during observed trips (McCandless et al. 2020). The following management measures were considered in the block averaging:

- 1998 –New England and Mid-Atlantic time/area closures to gillnets due to harbor porpoise interactions
- 2001 – Shark Finning Prohibition Act; LCS quota cut in half (set to 1997 levels that were not enacted until lawsuit was settled)
- 2003 – Move to regional quotas and trimester seasons, split LCS quota between ridgeback and non-ridgeback sharks, NC time/area closure
- 2008 – Shark Research Fishery implemented, sandbar sharks prohibited outside of research fishery, sharks landed with all fins attached
- 2013 – Removal of hammerheads (great, scalloped, smooth) from non-sandbar LCS management group quota

These measures resulted in four blocks: <1998, 1998-2007, 2008-2012, and 2013-2019. Due to years with zero values in the scalloped and/or smooth hammerhead data, the measures in 2001 and 2003 were not used in the block averaging.

Due to the low number of sets with discards in other bycatch data available for this assessment (SEDAR77-DW20 and SEDAR77-DW21), the SEDAR 77 panel approved using the grand mean discard ratio and annual effort for estimating annual discards in this assessment. This was the same method used in the back-calculation of discard estimates in this paper and was applied to the entire time series to create annual estimates for use in the SEDAR 77 assessment. The grand variance (GV) was used to calculate the 95% confidence interval (CI) for the grand mean (GM).

$$GV = \left[\sum_{h=1}^H (GM - R_h)^2 \right] / H - 1$$

$$95\% CI = 1.96\sqrt{GV} / \sqrt{H}$$

Where H is the total number of strata across all years. The lower and upper discard ratio limits for the grand mean were then used to calculate the 95% lower and upper confidence limits for the discard estimates by weight and number for each year.

Results

Estimated live and dead discards for scalloped and smooth hammerheads from 1995-2019 for the Northeast's sink gillnet fishery in the Mid-Atlantic from North Carolina to New York within the statistical areas identified in Figure 1 are summarized in Tables 1 and 3, respectively. Back-calculated estimates to 1981 for the same region are reported in Tables 2 and 4. Detailed strata results are given in Appendix 1 (Tables 1 through 4). Estimates produced from the multi-year block averaging of the discard ratios for scalloped and smooth hammerheads are reported in Tables 5 and 6, respectively. The final discard estimates for use in the SEDAR 77 assessment created using the grand mean discard ratios are reported in Tables 7 and 8 for scalloped and smooth hammerheads, respectively.

References

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Table 1. Scalloped hammerhead annual live and dead discard estimates with the corresponding variance and CV for the analyses.

year	total		OBS est number			est weight (lbs)			est number			est weight (lbs)		
	trips	trips	live disc	variance	CV	live disc	variance	CV	dead disc	variance	CV	dead disc	variance	CV
1995	17789	436	29	204.85	0.4904	379	34619.01	0.4904	29	204.85	0.4904	233	13110.16	0.4904
1996	15949	365	0			0			0			0		
1997	23649	384	0			0			0			0		
1998	34180	634	52	1812.64	0.8136	6803	30633658.76	0.8136	157	21700.27	0.9383	19362	341396701.74	0.9543
1999	39825	541	0			0			245	9878.35	0.4049	11703	73880604.35	0.7344
2000	38466	528	0			0			151	3023.65	0.3647	32230	132466642.00	0.3571
2001	28612	602	0			0			0			0		
2002	27983	304	0			0			0			0		
2003	32253	302	36	2345.45	1.3470	360	234545.47	1.3470	0			0		
2004	19520	598	875	263259.71	0.5863	73646	2102605790.81	0.6226	421	96866.80	0.7385	23514	198299506.38	0.5989
2005	18623	603	60	1577.60	0.6618	240	25241.64	0.6618	59	1964.92	0.7512	381	133522.61	0.9590
2006	19026	629	0			0			35	385.84	0.5543	239	20453.89	0.5979
2007	24208	696	150	2121.82	0.3079	4148	3870310.75	0.4743	0			0		
2008	17642	470	432	91291.19	0.6988	4217	7689318.74	0.6575	264	21379.85	0.5538	4035	3573669.55	0.4685
2009	22376	399	0			0			105	7721.51	0.8399	25945	754722794.74	1.0589
2010	19502	459	0			0			53	2585.34	0.9556	482	212526.77	0.9556
2011	26917	300	0			0			0			0		
2012	26148	309	0			0			23	1086.81	1.4137	6996	97812680.80	1.4137
2013	22247	369	53	2139.60	0.8782	3292	8693347.80	0.8956	88	5268.44	0.8286	4027	24314206.39	1.2245
2014	22901	487	88	2947.32	0.6149	11140	241197573.14	1.3941	116	9582.59	0.8465	19653	173384942.01	0.6700
2015	21264	627	169	1473.63	0.2270	14854	5535583.99	0.1584	255	2685.72	0.2035	31660	2817506.55	0.0530
2016	19050	1075	280	11481.69	0.3823	24818	105669876.78	0.4142	54	996.69	0.5861	7225	22553457.47	0.6573
2017	18306	1055	137	1914.77	0.3205	6090	7485540.68	0.4492	250	12976.29	0.4552	12363	26225701.38	0.4142
2018	16923	707	19	150.30	0.6360	2009	4676732.24	1.0765	15	151.68	0.8357	172	20486.18	0.8301
2019	20953	944	96	1507.49	0.4042	4768	4256086.36	0.4327	42	283.67	0.4022	5853	10670138.07	0.5581

Table 2. Back-calculated live and dead discard estimates for scalloped hammerheads based on average discard rates (1995-2019) and total annual landings for the analyses

year	total	ave num	est num	ave weight	est weight (lbs)	ave num	est num	ave weight	est weight (lbs)
	landings (lbs)	live d/k	live disc	live d/k	live disc	dead d/k	dead disc	dead d/k	dead disc
1981	*952070	0.0000040	4	0.0002151	205	0.0000051	5	0.0003480	331
1982	*800479	0.0000040	3	0.0002151	172	0.0000051	4	0.0003480	279
1983	*1633356	0.0000040	7	0.0002151	351	0.0000051	8	0.0003480	568
1984	*1109970	0.0000040	4	0.0002151	239	0.0000051	6	0.0003480	386
1985	*1393009	0.0000040	6	0.0002151	300	0.0000051	7	0.0003480	485
1986	*1665998	0.0000040	7	0.0002151	358	0.0000051	9	0.0003480	580
1987	*2535339	0.0000040	10	0.0002151	545	0.0000051	13	0.0003480	882
1988	*2641003	0.0000040	11	0.0002151	568	0.0000051	14	0.0003480	919
1989	7681371	0.0000040	31	0.0002151	1652	0.0000051	39	0.0003480	2673
1990	8883032	0.0000040	36	0.0002151	1911	0.0000051	45	0.0003480	3091
1991	14004376	0.0000040	56	0.0002151	3012	0.0000051	72	0.0003480	4873
1992	14803957	0.0000040	59	0.0002151	3184	0.0000051	76	0.0003480	5151
1993	21398090	0.0000040	86	0.0002151	4602	0.0000051	110	0.0003480	7446
1994	20856487	0.0000040	83	0.0002151	4486	0.0000051	107	0.0003480	7257

*Not all Mid-Atlantic states reported landings until 1989

Table 3. Smooth hammerhead annual live and dead discard estimates with the corresponding variance and CV for the analyses.

year	total		OBS est number			est weight (lbs)			est number			est weight (lbs)		
	trips	trips	live disc	variance	CV	live disc	variance	CV	dead disc	variance	CV	dead disc	variance	CV
1995	17789	436	0			0			0			0		
1996	15949	365	0			0			0			0		
1997	23649	384	307	7280.77	0.2783	2820	636071.58	0.2828	573	43769.25	0.3649	8176	64991013.93	0.9860
1998	34180	634	0			0			0			0		
1999	39825	541	0			0			0			0		
2000	38466	528	0			0			0			0		
2001	28612	602	0			0			0			0		
2002	27983	304	0			0			0			0		
2003	32253	302	79	4725.33	0.8708	696	398037.59	0.9069	0			0		
2004	19520	598	0			0			0			0		
2005	18623	603	0			0			15	395.97	1.3723	102	19402.71	1.3723
2006	19026	629	0			0			27	388.95	0.7197	124	7977.61	0.7195
2007	24208	696	0			0			210	19426.01	0.6640	315	43708.53	0.6640
2008	17642	470	458	15700.02	0.2733	5514	3203251.52	0.3246	576	56266.86	0.4122	3769	3230555.18	0.4769
2009	22376	399	0			0			0			0		
2010	19502	459	42	1139.28	0.8070	198	24169.88	0.7853	208	12144.40	0.5299	23336	653070387.03	1.0951
2011	26917	300	32	2001.60	1.3914	122	28903.06	1.3914	0			0		
2012	26148	309	47	1063.26	0.6992	1866	6904695.31	1.4085	0			0		
2013	22247	369	57	2174.51	0.8186	1256	13965042.97	2.9763	0			0		
2014	22901	487	14	493.85	1.6254	1367	4938529.73	1.6254	168	2928.65	0.3228	1413	777699.45	0.6242
2015	21264	627	149	1228.65	0.2346	4610	32606.00	0.0392	195	734.43	0.1393	4328	7974585.69	0.6524
2016	19050	1075	26	363.99	0.7271	1386	979675.95	0.7141	26	270.06	0.6263	1014	414240.47	0.6348
2017	18306	1055	16	214.21	0.9096	306	77328.27	0.9096	22	160.79	0.5823	247	37177.53	0.7801
2018	16923	707	7	74.77	1.2696	48	3663.51	1.2696	24	147.68	0.5103	2560	2398018.15	0.6048
2019	20953	944	18	110.80	0.5693	904	464873.06	0.7545	8	36.65	0.7753	23	329.82	0.7896

Table 4. Back-calculated live and dead discard estimates for smooth hammerheads based on average discard rates (1995-2019) and total annual landings for the analyses

year	total		ave num	est num	ave weight		ave num	est num	ave weight	
	landings (lbs)	live d/k			live d/k	live disc			dead d/k	dead disc
1981	*952070	0.0000027	3	0.0000386	37	0.0000052	5	0.0001878	179	
1982	*800479	0.0000027	2	0.0000386	31	0.0000052	4	0.0001878	150	
1983	*1633356	0.0000027	4	0.0000386	63	0.0000052	8	0.0001878	307	
1984	*1109970	0.0000027	3	0.0000386	43	0.0000052	6	0.0001878	208	
1985	*1393009	0.0000027	4	0.0000386	54	0.0000052	7	0.0001878	262	
1986	*1665998	0.0000027	5	0.0000386	64	0.0000052	9	0.0001878	313	
1987	*2535339	0.0000027	7	0.0000386	98	0.0000052	13	0.0001878	476	
1988	*2641003	0.0000027	7	0.0000386	102	0.0000052	14	0.0001878	496	
1989	7681371	0.0000027	21	0.0000386	296	0.0000052	40	0.0001878	1443	
1990	8883032	0.0000027	24	0.0000386	343	0.0000052	46	0.0001878	1668	
1991	14004376	0.0000027	38	0.0000386	540	0.0000052	73	0.0001878	2630	
1992	14803957	0.0000027	40	0.0000386	571	0.0000052	77	0.0001878	2780	
1993	21398090	0.0000027	58	0.0000386	826	0.0000052	111	0.0001878	4019	
1994	20856487	0.0000027	57	0.0000386	805	0.0000052	108	0.0001878	3917	

*Not all Mid-Atlantic states reported landings until 1989

Table 5. Scalloped hammerhead discard estimates from multi-year block averaging of the discard ratios

year	numbers				weight (lbs)				numbers				weight (lbs)			
	total catch kept (all sp.)	annual live d/k ave	live multi-year block d/k ave	est num live disc	annual live disc rate	live multi-year block rate ave	est weight live disc	annual dead disc rate	dead multi-year block rate ave	est num dead disc	annual dead disc rate	dead multi-year block rate ave	est weight dead disc			
1981	952070	0.0000040	0.0000033	3	0.0002151	0.0001778	169	0.0000051	0.0000043	4	0.0003480	0.0002870	273			
1982	800479	0.0000040	0.0000033	3	0.0002151	0.0001778	142	0.0000051	0.0000043	3	0.0003480	0.0002870	230			
1983	1633356	0.0000040	0.0000033	5	0.0002151	0.0001778	290	0.0000051	0.0000043	7	0.0003480	0.0002870	469			
1984	1109970	0.0000040	0.0000033	4	0.0002151	0.0001778	197	0.0000051	0.0000043	5	0.0003480	0.0002870	319			
1985	1393009	0.0000040	0.0000033	5	0.0002151	0.0001778	248	0.0000051	0.0000043	6	0.0003480	0.0002870	400			
1986	1665998	0.0000040	0.0000033	5	0.0002151	0.0001778	296	0.0000051	0.0000043	7	0.0003480	0.0002870	478			
1987	2535339	0.0000040	0.0000033	8	0.0002151	0.0001778	451	0.0000051	0.0000043	11	0.0003480	0.0002870	728			
1988	2641003	0.0000040	0.0000033	9	0.0002151	0.0001778	470	0.0000051	0.0000043	11	0.0003480	0.0002870	758			
1989	7681371	0.0000040	0.0000033	25	0.0002151	0.0001778	1366	0.0000051	0.0000043	33	0.0003480	0.0002870	2205			
1990	8883032	0.0000040	0.0000033	29	0.0002151	0.0001778	1579	0.0000051	0.0000043	38	0.0003480	0.0002870	2549			
1991	14004376	0.0000040	0.0000033	46	0.0002151	0.0001778	2490	0.0000051	0.0000043	60	0.0003480	0.0002870	4019			
1992	14803957	0.0000040	0.0000033	49	0.0002151	0.0001778	2632	0.0000051	0.0000043	64	0.0003480	0.0002870	4249			
1993	21398090	0.0000040	0.0000033	71	0.0002151	0.0001778	3805	0.0000051	0.0000043	92	0.0003480	0.0002870	6141			
1994	20856487	0.0000040	0.0000033	69	0.0002151	0.0001778	3708	0.0000051	0.0000043	90	0.0003480	0.0002870	5986			
1995	18574803	0.0000009	0.0000033	61	0.0000123	0.0001778	3303	0.0000009	0.0000043	80	0.0000076	0.0002870	5331			
1996	26013961	0	0.0000033	86	0	0.0001778	4625	0	0.0000043	112	0	0.0002870	7466			
1997	33567487	0	0.0000033	111	0	0.0001778	5968	0	0.0000043	144	0	0.0002870	9634			
1998	37990099	0.0000027	0.0000044	167	0.0003446	0.0002853	10839	0.0000080	0.0000051	194	0.0009807	0.0003564	1354			
1999	35233873	0	0.0000044	155	0	0.0002853	10052	0.0000098	0.0000051	180	0.0002550	0.0003564	1256			
2000	29740831	0	0.0000044	131	0	0.0002853	8485	0.0000064	0.0000051	152	0.0015018	0.0003564	1060			
2001	25990262	0	0.0000044	114	0	0.0002853	7415	0	0.0000051	133	0	0.0003564	926			
2002	22966222	0	0.0000044	101	0	0.0002853	6552	0	0.0000051	117	0	0.0003564	819			
2003	28133639	0.0000022	0.0000044	124	0.0000222	0.0002853	8027	0	0.0000051	143	0	0.0003564	1003			
2004	22495571	0.0000297	0.0000044	99	0.0023230	0.0002853	6418	0.0000202	0.0000051	115	0.0007861	0.0003564	802			
2005	20886990	0.0000038	0.0000044	92	0.0000151	0.0002853	5959	0.0000034	0.0000051	107	0.0000212	0.0003564	744			
2006	13680048	0	0.0000044	60	0	0.0002853	3903	0.0000028	0.0000051	70	0.0000189	0.0003564	488			
2007	25248342	0.0000052	0.0000044	111	0.0001485	0.0002853	7203	0	0.0000051	129	0	0.0003564	900			
2008	20668902	0.0000202	0.0000040	83	0.0002086	0.0000417	862	0.0000129	0.0000039	81	0.0002227	0.00002936	607			
2009	27306265	0	0.0000040	109	0	0.0000417	1139	0.0000036	0.0000039	106	0.0009535	0.00002936	802			
2010	14664473	0	0.0000040	59	0	0.0000417	612	0.0000020	0.0000039	57	0.0000178	0.00002936	431			
2011	30295460	0	0.0000040	121	0	0.0000417	1263	0	0.0000039	118	0	0.00002936	889			
2012	24959012	0	0.0000040	100	0	0.0000417	1041	0.0000009	0.0000039	97	0.0002741	0.00002936	733			
2013	23562221	0.0000021	0.0000051	120	0.0001289	0.0003290	7752	0.0000057	0.0000082	193	0.0001605	0.0005228	1232			
2014	31582469	0.0000023	0.0000051	161	0.0003814	0.0003290	10391	0.0000033	0.0000082	259	0.0004490	0.0005228	1651			
2015	120724151	0.0000021	0.0000051	616	0.0000977	0.0003290	39718	0.0000061	0.0000082	990	0.0001146	0.0005228	6311			
2016	19271696	0.0000138	0.0000051	98	0.0010733	0.0003290	6340	0.0000089	0.0000082	158	0.0008261	0.0005228	1008			
2017	18009161	0.0000079	0.0000051	92	0.0002874	0.0003290	5925	0.0000277	0.0000082	148	0.0008496	0.0005228	942			
2018	16100672	0.0000030	0.0000051	82	0.0001231	0.0003290	5297	0.0000007	0.0000082	132	0.0000080	0.0005228	842			
2019	18502297	0.0000043	0.0000051	94	0.0002110	0.0003290	6087	0.0000047	0.0000082	152	0.0012521	0.0005228	967			

Table 6. Smooth hammerhead discard estimates from multi-year block averaging of the discard ratios

year	numbers				weight (lbs)				numbers				weight (lbs)			
	total catch kept (all sp.)	annual live d/k ave	live multi-year block d/k ave	est num live disc	annual live disc rate	live multi-year block rate ave	est weight live disc	annual dead disc rate	dead multi-year block rate ave	est num dead disc	annual dead disc rate	dead multi-year block rate ave	est weight dead disc			
1981	952070	0.000027	0.000031	3	0.0000386	0.0000398	38	0.0000052	0.0000059	6	0.0001878	0.0001666	159			
1982	800479	0.000027	0.000031	2	0.0000386	0.0000398	32	0.0000052	0.0000059	5	0.0001878	0.0001666	133			
1983	1633356	0.000027	0.000031	5	0.0000386	0.0000398	65	0.0000052	0.0000059	10	0.0001878	0.0001666	272			
1984	1109970	0.000027	0.000031	3	0.0000386	0.0000398	44	0.0000052	0.0000059	7	0.0001878	0.0001666	185			
1985	1393009	0.000027	0.000031	4	0.0000386	0.0000398	55	0.0000052	0.0000059	8	0.0001878	0.0001666	232			
1986	1665998	0.000027	0.000031	5	0.0000386	0.0000398	66	0.0000052	0.0000059	10	0.0001878	0.0001666	278			
1987	2535339	0.000027	0.000031	8	0.0000386	0.0000398	101	0.0000052	0.0000059	15	0.0001878	0.0001666	422			
1988	2641003	0.000027	0.000031	8	0.0000386	0.0000398	105	0.0000052	0.0000059	16	0.0001878	0.0001666	440			
1989	7681371	0.000027	0.000031	24	0.0000386	0.0000398	306	0.0000052	0.0000059	45	0.0001878	0.0001666	1280			
1990	8883032	0.000027	0.000031	28	0.0000386	0.0000398	354	0.0000052	0.0000059	52	0.0001878	0.0001666	1480			
1991	14004376	0.000027	0.000031	43	0.0000386	0.0000398	557	0.0000052	0.0000059	83	0.0001878	0.0001666	2333			
1992	14803957	0.000027	0.000031	46	0.0000386	0.0000398	589	0.0000052	0.0000059	87	0.0001878	0.0001666	2466			
1993	21398090	0.000027	0.000031	66	0.0000386	0.0000398	852	0.0000052	0.0000059	126	0.0001878	0.0001666	3565			
1994	20856487	0.000027	0.000031	65	0.0000386	0.0000398	830	0.0000052	0.0000059	123	0.0001878	0.0001666	3475			
1995	18574803	0	0.000031	58	0	0.0000398	739	0	0.0000059	110	0	0.0001666	3095			
1996	26013961	0	0.000031	81	0	0.0000398	1035	0	0.0000059	153	0	0.0001666	4334			
1997	33567487	0.0000148	0.000031	104	0.0001361	0.0000398	1336	0.0000270	0.0000059	198	0.0002030	0.0001666	5592			
1998	3790099	0	0.000004	14	0	0.0000029	110	0	0.0000015	57	0	0.0000033	127			
1999	35233873	0	0.000004	13	0	0.0000029	102	0	0.0000015	53	0	0.0000033	118			
2000	29740831	0	0.000004	11	0	0.0000029	86	0	0.0000015	45	0	0.0000033	99			
2001	25990262	0	0.000004	10	0	0.0000029	75	0	0.0000015	39	0	0.0000033	87			
2002	22966222	0	0.000004	9	0	0.0000029	67	0	0.0000015	34	0	0.0000033	77			
2003	28133639	0.0000037	0.000004	10	0.0000290	0.0000029	82	0	0.0000015	42	0	0.0000033	94			
2004	22495571	0	0.000004	8	0	0.0000029	65	0	0.0000015	34	0	0.0000033	75			
2005	20886990	0	0.000004	8	0	0.0000029	61	0.0000008	0.0000015	31	0.0000053	0.0000033	70			
2006	13680048	0	0.000004	5	0	0.0000029	40	0.0000024	0.0000015	21	0.0000103	0.0000033	46			
2007	25248342	0	0.000004	9	0	0.0000029	73	0.0000119	0.0000015	38	0.0000178	0.0000033	84			
2008	20668902	0.0000298	0.000077	159	0.0003656	0.0000942	1947	0.0000371	0.0000133	275	0.0002418	0.0007207	14896			
2009	27306265	0	0.000077	210	0	0.0000942	2572	0	0.0000133	363	0	0.0007207	19680			
2010	14664473	0.0000061	0.000077	113	0.0000288	0.0000942	1381	0.0000292	0.0000133	195	0.0033616	0.0007207	10569			
2011	30295460	0.0000009	0.000077	233	0.0000034	0.0000942	2854	0	0.0000133	403	0	0.0007207	21834			
2012	24959012	0.0000018	0.000077	192	0.0000731	0.0000942	2351	0	0.0000133	332	0	0.0007207	17988			
2013	23562221	0.0000034	0.000016	38	0.0000518	0.0000470	1107	0	0.0000031	73	0	0.0001222	2879			
2014	31582469	0.0000005	0.000016	51	0.0000496	0.0000470	1484	0.0000076	0.0000031	98	0.0000490	0.0001222	3858			
2015	120724151	0.0000018	0.000016	193	0.0000073	0.0000470	5674	0.0000017	0.0000031	373	0.0001026	0.0001222	14749			
2016	19271696	0.0000033	0.000016	31	0.0001630	0.0000470	906	0.0000033	0.0000031	60	0.0001119	0.0001222	2354			
2017	18009161	0.0000006	0.000016	29	0.0000122	0.0000470	846	0.0000019	0.0000031	56	0.0000112	0.0001222	2200			
2018	16100672	0.0000005	0.000016	26	0.0000035	0.0000470	757	0.0000054	0.0000031	50	0.0005752	0.0001222	1967			
2019	18502297	0.0000008	0.000016	30	0.0000414	0.0000470	870	0.0000018	0.0000031	57	0.0000053	0.0001222	2260			

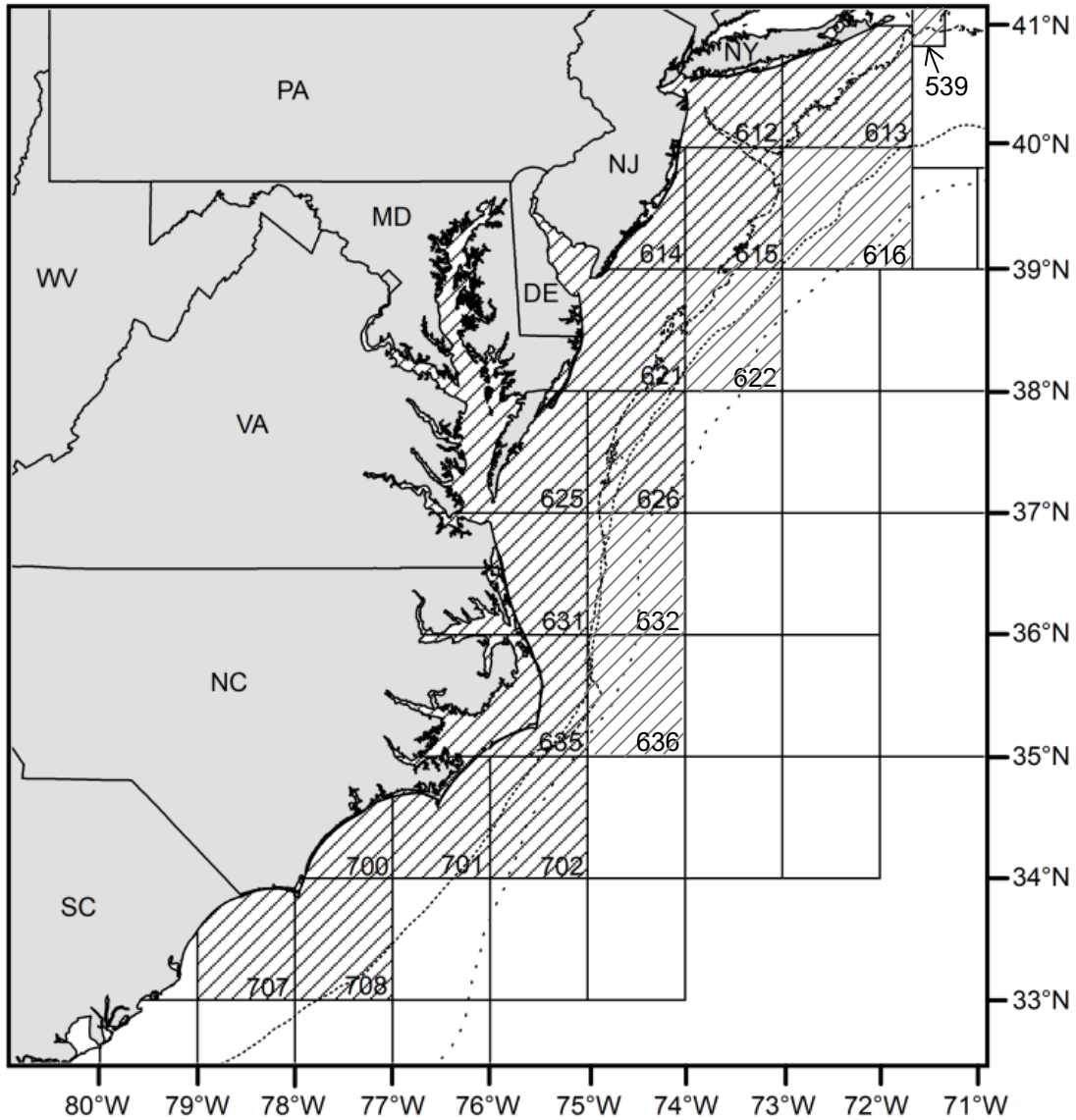
Table 7. Scalloped hammerhead final discard estimates created using the grand mean discard ratio for use in the SEDAR 77 assessment for this species

year	total landings (lbs)	ave num live d/k	est num live disc	95% LCL	95% UCL	ave wgt live d/k	est wgt (lbs) live disc	95% LCL	95% UCL	ave num dead d/k	est num dead disc	95% LCL	95% UCL	ave wgt dead d/k	est wgt (lbs) dead disc	95% LCL	95% UCL
1981	952070	0.0000040	4	2	6	0.0002151	205	40	369	0.0000051	5	3	7	0.0003480	331	143	520
1982	800479	0.0000040	3	1	5	0.0002151	172	34	311	0.0000051	4	2	6	0.0003480	279	120	437
1983	1633356	0.0000040	7	3	10	0.0002151	351	69	634	0.0000051	8	4	12	0.0003480	568	245	891
1984	1109970	0.0000040	4	2	7	0.0002151	239	47	431	0.0000051	6	3	8	0.0003480	386	167	606
1985	1393009	0.0000040	6	2	9	0.0002151	300	59	540	0.0000051	7	4	10	0.0003480	485	209	760
1986	1665998	0.0000040	7	3	11	0.0002151	358	70	646	0.0000051	9	5	12	0.0003480	580	250	909
1987	2535339	0.0000040	10	4	16	0.0002151	545	107	984	0.0000051	13	7	19	0.0003480	882	381	1384
1988	2641003	0.0000040	11	4	17	0.0002151	568	111	1025	0.0000051	14	7	20	0.0003480	919	397	1441
1989	7681371	0.0000040	31	13	49	0.0002151	1652	324	2980	0.0000051	39	21	58	0.0003480	2673	1154	4192
1990	8883032	0.0000040	36	15	56	0.0002151	1911	375	3446	0.0000051	45	24	67	0.0003480	3091	1334	4848
1991	14004376	0.0000040	56	23	89	0.0002151	3012	591	5433	0.0000051	72	39	105	0.0003480	4873	2103	7643
1992	14803957	0.0000040	59	25	94	0.0002151	3184	625	5743	0.0000051	76	41	111	0.0003480	5151	2224	8079
1993	21398090	0.0000040	86	36	136	0.0002151	4602	903	8301	0.0000051	110	59	160	0.0003480	7446	3214	11678
1994	20856487	0.0000040	83	35	132	0.0002151	4486	880	8091	0.0000051	107	57	156	0.0003480	7257	3133	11382
1995	18574803	0.0000040	74	31	118	0.0002151	3995	784	7206	0.0000051	95	51	139	0.0003480	6463	2790	10137
1996	26013961	0.0000040	104	43	165	0.0002151	5595	1098	10092	0.0000051	133	72	195	0.0003480	9052	3907	14197
1997	33567487	0.0000040	134	56	213	0.0002151	7220	1417	13022	0.0000051	172	92	251	0.0003480	11680	5042	18319
1998	37990099	0.0000040	152	63	241	0.0002151	8171	1604	14738	0.0000051	195	105	285	0.0003480	13219	5706	20733
1999	35233873	0.0000040	141	59	223	0.0002151	7578	1487	13669	0.0000051	180	97	264	0.0003480	12260	5292	19228
2000	29740831	0.0000040	119	49	188	0.0002151	6397	1255	11538	0.0000051	152	82	223	0.0003480	10349	4467	16231
2001	25990262	0.0000040	104	43	165	0.0002151	5590	1097	10083	0.0000051	133	71	195	0.0003480	9044	3904	14184
2002	22966222	0.0000040	92	38	146	0.0002151	4940	970	8910	0.0000051	118	63	172	0.0003480	7991	3449	12533
2003	28133639	0.0000040	113	47	178	0.0002151	6051	1188	10914	0.0000051	144	77	211	0.0003480	9790	4226	15354
2004	22495571	0.0000040	90	37	143	0.0002151	4838	950	8727	0.0000051	115	62	168	0.0003480	7828	3379	12277
2005	20886990	0.0000040	84	35	132	0.0002151	4492	882	8103	0.0000051	107	57	156	0.0003480	7268	3137	11399
2006	13680048	0.0000040	55	23	87	0.0002151	2942	577	5307	0.0000051	70	38	102	0.0003480	4760	2055	7466
2007	25248342	0.0000040	101	42	160	0.0002151	5430	1066	9795	0.0000051	129	69	189	0.0003480	8786	3792	13779
2008	20668902	0.0000040	83	34	131	0.0002151	4445	873	8018	0.0000051	106	57	155	0.0003480	7192	3104	11280
2009	27306265	0.0000040	109	45	173	0.0002151	5873	1153	10593	0.0000051	140	75	205	0.0003480	9502	4101	14902
2010	14664473	0.0000040	59	24	93	0.0002151	3154	619	5689	0.0000051	75	40	110	0.0003480	5103	2203	8003
2011	30295460	0.0000040	121	50	192	0.0002151	6516	1279	11753	0.0000051	155	83	227	0.0003480	10542	4550	16533
2012	24959012	0.0000040	100	41	158	0.0002151	5368	1054	9683	0.0000051	128	69	187	0.0003480	8685	3749	13621
2013	23562221	0.0000040	94	39	149	0.0002151	5068	995	9141	0.0000051	121	65	176	0.0003480	8199	3539	12859
2014	31582469	0.0000040	126	53	200	0.0002151	6793	1333	12252	0.0000051	162	87	237	0.0003480	10990	4744	17236
2015	120724151	0.0000040	483	201	765	0.0002151	25965	5096	46834	0.0000051	618	332	904	0.0003480	42008	18132	65883
2016	19271696	0.0000040	77	32	122	0.0002151	4145	814	7476	0.0000051	99	53	144	0.0003480	6706	2895	10517
2017	18009161	0.0000040	72	30	114	0.0002151	3873	760	6987	0.0000051	92	50	135	0.0003480	6267	2705	9828
2018	16100672	0.0000040	64	27	102	0.0002151	3463	680	6246	0.0000051	82	44	121	0.0003480	5602	2418	8787
2019	18502297	0.0000040	74	31	117	0.0002151	3979	781	7178	0.0000051	95	51	139	0.0003480	6438	2779	10097

Table 8. Smooth hammerhead final discard estimates created using the grand mean discard ratio for use in the SEDAR 77 assessment for this species

year	total landings (lbs)	ave num live d/k	est num live disc	95% LCL	95% UCL	ave wgt live d/k	est wgt (lbs) live disc	95% LCL	95% UCL	ave num dead d/k	est num dead disc	95% LCL	95% UCL	ave wgt dead d/k	est wgt (lbs) dead disc	95% LCL	95% UCL
1981	952070	0.0000027	3	2	3	0.0000386	37	26	47	0.0000052	5	4	6	0.0001878	179	92	266
1982	800479	0.0000027	2	1	3	0.0000386	31	22	40	0.0000052	4	3	5	0.0001878	150	77	223
1983	1633356	0.0000027	4	3	6	0.0000386	63	45	81	0.0000052	8	6	11	0.0001878	307	158	456
1984	1109970	0.0000027	3	2	4	0.0000386	43	31	55	0.0000052	6	4	7	0.0001878	208	107	310
1985	1393009	0.0000027	4	3	5	0.0000386	54	39	69	0.0000052	7	5	9	0.0001878	262	134	389
1986	1665998	0.0000027	5	3	6	0.0000386	64	46	82	0.0000052	9	6	11	0.0001878	313	161	465
1987	2535339	0.0000027	7	5	9	0.0000386	98	70	125	0.0000052	13	10	17	0.0001878	476	245	707
1988	2641003	0.0000027	7	5	9	0.0000386	102	73	131	0.0000052	14	10	17	0.0001878	496	255	737
1989	7681371	0.0000027	21	14	27	0.0000386	296	213	380	0.0000052	40	29	51	0.0001878	1443	742	2143
1990	8883032	0.0000027	24	17	32	0.0000386	343	246	439	0.0000052	46	34	59	0.0001878	1668	858	2479
1991	14004376	0.0000027	38	26	50	0.0000386	540	388	693	0.0000052	73	53	93	0.0001878	2630	1352	3908
1992	14803957	0.0000027	40	28	53	0.0000386	571	410	732	0.0000052	77	56	98	0.0001878	2780	1429	4131
1993	21398090	0.0000027	58	40	77	0.0000386	826	593	1059	0.0000052	111	81	141	0.0001878	4019	2066	5971
1994	20856487	0.0000027	57	39	75	0.0000386	805	578	1032	0.0000052	108	79	138	0.0001878	3917	2014	5820
1995	18574803	0.0000027	51	35	66	0.0000386	717	514	919	0.0000052	97	70	123	0.0001878	3488	1793	5183
1996	26013961	0.0000027	71	49	93	0.0000386	1004	720	1287	0.0000052	135	99	172	0.0001878	4885	2512	7259
1997	33567487	0.0000027	91	63	120	0.0000386	1295	930	1661	0.0000052	175	127	222	0.0001878	6304	3241	9367
1998	37990099	0.0000027	103	71	136	0.0000386	1466	1052	1879	0.0000052	198	144	251	0.0001878	7134	3668	10601
1999	35233873	0.0000027	96	66	126	0.0000386	1359	976	1743	0.0000052	183	134	233	0.0001878	6617	3402	9832
2000	29740831	0.0000027	81	56	106	0.0000386	1147	824	1471	0.0000052	155	113	197	0.0001878	5585	2871	8299
2001	25990262	0.0000027	71	49	93	0.0000386	1003	720	1286	0.0000052	135	99	172	0.0001878	4881	2509	7253
2002	22966222	0.0000027	62	43	82	0.0000386	886	636	1136	0.0000052	119	87	152	0.0001878	4313	2217	6409
2003	28133639	0.0000027	77	53	101	0.0000386	1085	779	1392	0.0000052	146	107	186	0.0001878	5283	2716	7851
2004	22495571	0.0000027	61	42	80	0.0000386	868	623	1113	0.0000052	117	85	149	0.0001878	4225	2172	6277
2005	20886990	0.0000027	57	39	75	0.0000386	806	578	1033	0.0000052	109	79	138	0.0001878	3923	2017	5828
2006	13680048	0.0000027	37	26	49	0.0000386	528	379	677	0.0000052	71	52	90	0.0001878	2569	1321	3817
2007	25248342	0.0000027	69	47	90	0.0000386	974	699	1249	0.0000052	131	96	167	0.0001878	4742	2438	7045
2008	20668902	0.0000027	56	39	74	0.0000386	797	572	1022	0.0000052	108	78	137	0.0001878	3882	1996	5768
2009	27306265	0.0000027	74	51	98	0.0000386	1054	756	1351	0.0000052	142	104	181	0.0001878	5128	2636	7620
2010	14664473	0.0000027	40	27	52	0.0000386	566	406	725	0.0000052	76	56	97	0.0001878	2754	1416	4092
2011	30295460	0.0000027	82	57	108	0.0000386	1169	839	1499	0.0000052	158	115	200	0.0001878	5689	2925	8454
2012	24959012	0.0000027	68	47	89	0.0000386	963	691	1235	0.0000052	130	95	165	0.0001878	4687	2410	6965
2013	23562221	0.0000027	64	44	84	0.0000386	909	653	1166	0.0000052	123	89	156	0.0001878	4425	2275	6575
2014	31582469	0.0000027	86	59	113	0.0000386	1219	875	1562	0.0000052	164	120	209	0.0001878	5931	3049	8813
2015	120724151	0.0000027	328	225	432	0.0000386	4658	3343	5972	0.0000052	628	458	798	0.0001878	22672	11656	33688
2016	19271696	0.0000027	52	36	69	0.0000386	744	534	953	0.0000052	100	73	127	0.0001878	3619	1861	5378
2017	18009161	0.0000027	49	34	64	0.0000386	695	499	891	0.0000052	94	68	119	0.0001878	3382	1739	5025
2018	16100672	0.0000027	44	30	58	0.0000386	621	446	796	0.0000052	84	61	106	0.0001878	3024	1555	4493
2019	18502297	0.0000027	50	35	66	0.0000386	714	512	915	0.0000052	96	70	122	0.0001878	3475	1786	5163

Figure 1. Statistical Areas (shaded) used for estimation of scalloped and smooth hammerhead discards from the Northeast Region's Mid-Atlantic sink-gillnet fishery.



Appendix 1. Table 1. Scalloped hammerhead live discard ratios & estimated quarterly discards

year	qtr	total trips	OBS trips	OBS total catch kept	numbers live disc	weight live disc	numbers live d/k	weight live d/k	total catch kept	est number live disc	est weight live disc	variance	est weight variance
1995	1	4246	168	696215	0	0	0	0	3033632	0	0		
1995	2	6903	107	263272	1	13	0.00000380	0.00004938	7683314	29	379	845.61	142908.29
1995	3	1995	57	81148	0	0	0	0	3281504	0	0		
1995	4	4645	104	242037	0	0	0	0	4576353	0	0		
1996	1	3918	147	745069	0	0	0	0	6680287	0	0		
1996	2	6081	92	269840	0	0	0	0	9506248	0	0		
1996	3	1744	51	69453	0	0	0	0	3621887	0	0		
1996	4	4206	75	200042	0	0	0	0	6205539	0	0		
1997	1	7442	158	624082	0	0	0	0	13437884	0	0		
1997	2	7171	122	370238	0	0	0	0	7662161	0	0		
1997	3	3617	44	84522	0	0	0	0	5182111	0	0		
1997	4	5419	60	165160	0	0	0	0	7285331	0	0		
1998	1	7139	188	721302	0	0	0	0	11593825	0	0		
1998	2	10044	171	445545	0	0	0	0	11095710	0	0		
1998	3	6538	74	188650	2	260	0.00001060	0.00137821	4936105	52	6803	2669.68	45117530.80
1998	4	10459	201	389565	0	0	0	0	10364459	0	0		
1999	1	9966	178	415409	0	0	0	0	15419441	0	0		
1999	2	12978	165	258078	0	0	0	0	10703373	0	0		
1999	3	6921	57	34398	0	0	0	0	4313068	0	0		
1999	4	9960	141	151499	0	0	0	0	4797991	0	0		
2000	1	9404	167	315222	0	0	0	0	10613819	0	0		
2000	2	13972	128	169855	0	0	0	0	7561112	0	0		
2000	3	8506	54	50335	0	0	0	0	5347853	0	0		
2000	4	6584	179	213672	0	0	0	0	6218047	0	0		
2001	1	4106	114	250449	0	0	0	0	5472383	0	0		
2001	2	9685	321	425054	0	0	0	0	7643587	0	0		
2001	3	6625	29	25998	0	0	0	0	4515072	0	0		
2001	4	8196	138	188893	0	0	0	0	8359220	0	0		
2002	1	3518	60	129338	0	0	0	0	6346260	0	0		
2002	2	7229	103	162948	0	0	0	0	6573098	0	0		
2002	3	7511	39	41320	0	0	0	0	4232936	0	0		
2002	4	9725	102	113002	0	0	0	0	5813928	0	0		
2003	1	4426	42	128509	0	0	0	0	6790982	0	0		
2003	2	11792	85	165439	0	0	0	0	10075795	0	0		
2003	3	6710	65	112425	1	10	0.00000889	0.00008895	4042000	36	360	1278.99	127899.10
2003	4	9325	110	168057	0	0	0	0	7224862	0	0		
2004	1	2878	84	233932	21	1910	0.00008977	0.00816476	8259297	741	67435	512759.14	4241715692.07
2004	2	5269	199	285877	1	225	0.00000350	0.00078705	5988588	21	4713	421.93	21360318.85
2004	3	4309	97	113572	0	0	0	0	3848151	0	0		
2004	4	7064	218	273249	7	93	0.00002562	0.00034035	4399535	113	1497	5231.22	910084.56
2005	1	1604	118	283264	0	0	0	0	4921520	0	0		
2005	2	6743	166	286338	0	0	0	0	7193762	0	0		
2005	3	5108	115	132707	2	8	0.00001507	0.00006028	3982075	60	240	3532.17	56514.68
2005	4	5168	204	330316	0	0	0	0	4789633	0	0		
2006	1	2651	121	306420	0	0	0	0	3818953	0	0		
2006	2	6848	214	323676	0	0	0	0	4701491	0	0		
2006	3	4267	122	154976	0	0	0	0	1995687	0	0		
2006	4	5260	172	178552	0	0	0	0	3163917	0	0		
2007	1	2901	170	392488	1	80	0.00000255	0.00020383	6026071	15	1228	215.71	1423825.81
2007	2	7834	223	335202	3	103	0.00000895	0.00030728	7548332	68	2319	493.29	307939.97
2007	3	5574	126	126277	0	0	0	0	4417444	0	0		
2007	4	7899	177	217616	2	18	0.00000919	0.00008271	7256495	67	600	2149.62	182664.01

Appendix 1. Table 1. Scalloped hammerhead live discard ratios & estimated quarterly discards

year	qtr	total trips	OBS trips	OBS total catch kept	numbers live disc	weight live disc	numbers live d/k	weight live d/k	total catch kept	est number live disc	est weight live disc	variance	est weight variance
2008	1	2191	85	170841	0	0	0	0	3976648	0	0		
2008	2	7015	148	237764	1	5.4	0.00000421	0.00002271	7460250	31	169	950.74	27723.69
2008	3	3338	76	82256	1	20	0.00001216	0.00024314	3689063	45	897		
2008	4	5098	161	202308	13	115	0.00006426	0.00056844	5542941	356	3151	76284.14	6464770.06
2009	1	2892	76	160875	0	0	0	0	6917752	0	0		
2009	2	7799	132	283343	0	0	0	0	8787736	0	0		
2009	3	5642	72	55119	0	0	0	0	4808684	0	0		
2009	4	6043	119	184534	0	0	0	0	6792093	0	0		
2010	1	1809	64	123383	0	0	0	0	1720222	0	0		
2010	2	7297	155	381766	0	0	0	0	6771064	0	0		
2010	3	4987	68	56011	0	0	0	0	2469085	0	0		
2010	4	5409	172	290034	0	0	0	0	3704102	0	0		
2011	1	3723	78	169470	0	0	0	0	7495344	0	0		
2011	2	8850	75	175553	0	0	0	0	8575632	0	0		
2011	3	6031	39	47146	0	0	0	0	5147161	0	0		
2011	4	8313	108	282300	0	0	0	0	9077323	0	0		
2012	1	4062	129	273619	0	0	0	0	6380538	0	0		
2012	2	9197	93	361257	0	0	0	0	8733780	0	0		
2012	3	5715	34	37813	0	0	0	0	3447968	0	0		
2012	4	7174	53	78464	0	0	0	0	6396726	0	0		
2013	1	4006	70	170771	0	0	0	0	5370857	0	0		
2013	2	7481	70	186468	0	0	0	0	8518949	0	0		
2013	3	4638	101	107371	0	0	0	0	3288687	0	0		
2013	4	6122	128	242394	2	125	0.00000825	0.00051569	6383728	53	3292	1337.10	5432735.10
2014	1	2763	146	504205	2	700	0.00000397	0.00138832	6893432	27	9570	708.08	86740349.93
2014	2	8256	127	375519	2	51.5	0.00000533	0.00013714	11444388	61	1570	1838.76	1593006.89
2014	3	4951	71	77747	0	0	0	0	4801730	0	0		
2014	4	6931	143	449829	0	0	0	0	8442919	0	0		
2015	1	3154	121	470618	2	30	0.00000425	0.00006375	6620887	28	422	765.02	172130.39
2015	2	7038	164	413372	1	45	0.00000242	0.00010886	9505474	23	1035	519.08	1051134.76
2015	3	4964	125	154867	0	0	0.00000000	0.00000000	3747031	0	0		
2015	4	6108	217	642034	1	140	0.00000156	0.00021806	6883195	11	1501	111.11	2177739.92
2016	1	3539	259	974206	32	2155	0.00003285	0.00221206	6131022	201	13562	7930.51	44161841.67
2016	2	6456	283	738565	1	40	0.00000135	0.00005416	6416448	9	348	72.38	115801.79
2016	3	3017	188	193027	2	38	0.00001036	0.00019686	855439	9	168	73.72	26614.23
2016	4	6038	345	860627	9	1575	0.00001046	0.00183006	5868787	61	10740	1333.17	48548177.39
2017	1	4050	267	736144	5	488	0.00000679	0.00066291	5456725	37	3617	665.61	6100796.76
2017	2	5724	275	779957	8	147.9	0.00001026	0.00018963	6275152	64	1190	974.15	473005.14
2017	3	2936	226	199751	2	11	0.00001001	0.00005507	1262255	13	70	73.29	3728.23
2017	4	5596	287	669476	3	162	0.00000448	0.00024198	5015029	22	1214	265.00	697021.67
2018	1	2871	114	504629	0	0	0	0	3436693	0	0		
2018	2	5879	216	481377	0	0	0	0	6173146	0	0		
2018	3	3154	139	93445	1	14	0.00001070	0.00014982	1112750	12	167	136.04	26663.01
2018	4	5019	238	729857	1	250	0.00000137	0.00034253	5378083	7	1842	50.99	3186601.93
2019	1	5012	284	989920	2	100	0.00000202	0.00010102	5306652	11	536	54.19	135484.46
2019	2	6881	278	867758	13	644.6	0.00001498	0.00074283	5696343	85	4231	1601.93	4549424.15
2019	3	4024	123	141689	0	0	0	0	1106358	0	0		
2019	4	5036	259	969160	0	0	0	0	6392944	0	0		
1995 - 2019 AVERAGE							0.0000040	0.0002151					

Appendix 1. Table 2. Scalloped hammerhead dead discard ratios & estimated quarterly discards

year	qtr	total trips	OBS trips	OBS total catch	numbers dead	weight disc	numbers dead d/k	weight dead d/k	total catch kept	est number dead disc	est weight variance	est weight dead disc	est weight variance
1995	1	4246	168	696215	0	0	0	0	3033632	0		0	
1995	2	6903	107	263272	1	8	0.0000038	0.0000304	7683314	29	845.61	233	54119.12
1995	3	1995	57	81148	0	0	0	0	3281504	0		0	
1995	4	4645	104	242037	0	0	0	0	4576353	0		0	
1996	1	3918	147	745069	0	0	0	0	6680287	0		0	
1996	2	6081	92	269840	0	0	0	0	9506248	0		0	
1996	3	1744	51	69453	0	0	0	0	3621887	0		0	
1996	4	4206	75	200042	0	0	0	0	6205539	0		0	
1997	1	7442	158	624082	0	0	0	0	13437884	0		0	
1997	2	7171	122	370238	0	0	0	0	7662161	0		0	
1997	3	3617	44	84522	0	0	0	0	5182111	0		0	
1997	4	5419	60	165160	0	0	0	0	7285331	0		0	
1998	1	7139	188	721302	0	0	0	0	11593825	0		0	
1998	2	10044	171	445545	0	0	0	0	11095710	0		0	
1998	3	6538	74	188650	6	740	0.0000318	0.0039226	4936105	157	31960.35	19362	502812162.43
1998	4	10459	201	389565	0	0	0	0	10364459	0		0	
1999	1	9966	178	415409	1	200	0.0000024	0.0004815	15419441	37	1298.74	7424	51949616.81
1999	2	12978	165	258078	2	79	0.0000077	0.0003061	10703373	83	6829.73	3276	10656088.89
1999	3	6921	57	34398	1	8	0	0	4313068	125	15789.97	1003	1010558.11
1999	4	9960	141	151499	0	0	0	0	4797991	0		0	
2000	1	9404	167	315222	0	0	0	0	10613819	0		0	
2000	2	13972	128	169855	1	8	0	0	7561112	45	1972.89	356	126264.66
2000	3	8506	54	50335	1	300	0.0000199	0.0059600	5347853	106	10790.47	31873	971142305.50
2000	4	6584	179	213672	0	0	0	0	6218047	0		0	
2001	1	4106	114	250449	0	0	0	0	5472383	0		0	
2001	2	9685	321	425054	0	0	0	0	7643587	0		0	
2001	3	6625	29	25998	0	0	0	0	4515072	0		0	
2001	4	8196	138	188893	0	0	0	0	8359220	0		0	
2002	1	3518	60	129338	0	0	0	0	6346260	0		0	
2002	2	7229	103	162948	0	0	0	0	6573098	0		0	
2002	3	7511	39	41320	0	0	0	0	4232936	0		0	
2002	4	9725	102	113002	0	0	0	0	5813928	0		0	
2003	1	4426	42	128509	0	0	0	0	6790982	0		0	
2003	2	11792	85	165439	0	0	0	0	10075795	0		0	
2003	3	6710	65	112425	0	0	0	0	4042000	0		0	
2003	4	9325	110	168057	0	0	0	0	7224862	0		0	
2004	1	2878	84	233932	4	580	0.0000171	0.0024794	8259297	141	18603.51	20478	391138718.46
2004	2	5269	199	285877	1	26	0.0000035	0.0000909	5988588	21	423.77	545	286466.30
2004	3	4309	97	113572	1	7	0.0000088	0.0000616	3848151	34	1133.53	237	55542.96
2004	4	7064	218	273249	14	140	0.0000512	0.0005124	4399535	225	36560.35	2254	2935943.77
2005	1	1604	118	283264	0	0	0	0	4921520	0		0	
2005	2	6743	166	286338	0	0	0	0	7193762	0		0	
2005	3	5108	115	132707	1	4	0.0000075	0.0000301	3982075	30	883.04	120	14128.67
2005	4	5168	204	330316	2	18	0.0000061	0.0000545	4789633	29	803.78	261	65106.44
2006	1	2651	121	306420	0	0	0	0	3818953	0		0	
2006	2	6848	214	323676	0	0	0	0	4701491	0		0	
2006	3	4267	122	154976	0	0	0	0	1995687	0		0	
2006	4	5260	172	178552	2	14	0.0000112	0.0000756	3163917	35	603.91	239	32014.01
2007	1	2901	170	392488	0	0	0	0	6026071	0		0	
2007	2	7834	223	335202	0	0	0	0	7548332	0		0	
2007	3	5574	126	126277	0	0	0	0	4417444	0		0	
2007	4	7899	177	217616	0	0	0	0	7256495	0		0	

Appendix 1. Table 2. Scalloped hammerhead dead discard ratios & estimated quarterly discards

year	qtr	total trips	OBS trips	OBS total catch	OBS total kept	numbers dead	weight dead	numbers d/k	weight d/k	total catch kept	est number dead disc	est weight variance	est weight dead disc	est weight variance
2008	1	2191	85	170841		0	0	0	0	3976648	0		0	
2008	2	7015	148	237764		0	0	0	0	7460250	0		0	
2008	3	3338	76	82256		1	40	0.0000122	0.0004863	3689063	45	1926.26	1794	3082023.03
2008	4	5098	161	202308		8	82	0.0000395	0.0004043	5542941	219	17325.72	2241	1882369.02
2009	1	2892	76	160875		0	0	0	0	6917752	0		0	
2009	2	7799	132	283343		1	6	0	0	8787736	31	947.44	180	31872.01
2009	3	5642	72	55119		0	0	0	0	4808684	0		0	
2009	4	6043	119	184534		2	700	0.0000108	0.0037933	6792093	74	5255.94	25765	643853217.48
2010	1	1809	64	123383		0	0	0	0	1720222	0		0	
2010	2	7297	155	381766		3	27	0.0000079	0.0000712	6771064	53	2758.32	482	226746.19
2010	3	4987	68	56011		0	0	0	0	2469085	0		0	
2010	4	5409	172	290034		0	0	0	0	3704102	0		0	
2011	1	3723	78	169470		0	0	0	0	7495344	0		0	
2011	2	8850	75	175553		0	0	0	0	8575632	0		0	
2011	3	6031	39	47146		0	0	0	0	5147161	0		0	
2011	4	8313	108	282300		0	0	0	0	9077323	0		0	
2012	1	4062	129	273619		1	300	0.0000037	0.0010964	6380538	23	526.86	6996	47417409.25
2012	2	9197	93	361257		0	0	0	0	8733780	0		0	
2012	3	5715	34	37813		0	0	0	0	3447968	0		0	
2012	4	7174	53	78464		0	0	0	0	6396726	0		0	
2013	1	4006	70	170770.66		0	0	0	0	5370857	0		0	
2013	2	7481	70	186467.93		0	0	0	0	8518949	0		0	
2013	3	4638	101	107371		2	3	0.0000186	0.0000233	3288687	61	3544.40	77	5538.13
2013	4	6122	128	242393.695		1	150	0.0000041	0.0006188	6383728	26	675.14	3950	15190591.06
2014	1	2763	146	504205.192		4	100	0.0000079	0.0001983	6893432	55	2782.41	1367	1739008.27
2014	2	8256	127	375519.2555		2	600	0.0000053	0.0015978	11444388	61	3495.21	18286	314569310.03
2014	3	4951	71	77747.2512		0	0	0	0	4801730	0		0	
2014	4	6931	143	449828.8456		0	0	0	0	8442919	0		0	
2015	1	3154	121	470617.57		2	70	0.0000042	0.0001487	6620887	28	765.02	985	937154.34
2015	2	7038	164	413372.3317		3	124	0.0000073	0.0003000	9505474	69	1544.83	2851	3405357.90
2015	3	4964	125	154866.7506		2	2	0.0000129	0.0000097	3747031	48	2269.24	36	1276.45
2015	4	6108	217	642034.4215		0	0	0	0	6883195	0		0	
2016	1	3539	259	974205.5605		0	0	0	0	6131022	0		0	
2016	2	6456	283	738564.5565		0	0	0	0	6416448	0		0	
2016	3	3017	188	193026.6		6	469	0.0000311	0.0024271	855439	27	219.38	2076	2383252.07
2016	4	6038	345	860626.9847		4	755	0.0000046	0.0008773	5868787	27	435.19	5148	15977399.83
2017	1	4050	267	736144.0501		15	1235	0.0000204	0.0016777	5456725	111	5078.52	9155	17764752.29
2017	2	5724	275	779956.6669		3	74	0.0000038	0.0000949	6275152	24	550.64	595	335942.36
2017	3	2936	226	199751.1501		17	295	0.0000851	0.0014763	1262255	107	4918.89	1864	1409664.43
2017	4	5596	287	669476.4223		1	100	0.0000015	0.0001494	5015029	7	52.89	749	531332.01
2018	1	2871	114	504628.85		0	0	0	0	3436693	0		0	
2018	2	5879	216	481377.2192		0	0	0	0	6173146	0		0	
2018	3	3154	139	93444.63234		0	0	0	0	1112750	0		0	
2018	4	5019	238	729856.8231		2	23	0.0000027	0.0000321	5378083	15	103.68	172	14003.17
2019	1	5012	284	989919.9613		0	0	0	0	5306652	0		0	
2019	2	6881	278	867758.1415		4	59	0.0000046	0.0000680	5696343	26	243.84	387	105462.89
2019	3	4024	123	141688.9503		2	700	0.0000141	0.0049404	1106358	16	105.06	5466	16970150.61
2019	4	5036	259	969160.312		0	0	0	0	6392944	0		0	
						1995-2019 AVERAGE	0.0000051	0.0003480						

Appendix 1. Table 3. Smooth hammerhead live discard ratios & estimated quarterly discards

year	qtr	total OBS		OBS total catch kept	numbers weight		numbers weight		total catch kept	est number			est weight	
		trips	trips		live disc	live disc	live d/k	live d/k		year	live disc	variance	live disc	variance
1995	1	4246	168	696215	0	0	0	0	3033632	1995	0		0	
1995	2	6903	107	263272	0	0	0	0	7683314	1995	0		0	
1995	3	1995	57	81148	0	0	0	0	3281504	1995	0		0	
1995	4	4645	104	242037	0	0	0	0	4576353	1995	0		0	
1996	1	3918	147	745069	0	0	0	0	6680287	1996	0		0	
1996	2	6081	92	269840	0	0	0	0	9506248	1996	0		0	
1996	3	1744	51	69453	0	0	0	0	3621887	1996	0		0	
1996	4	4206	75	200042	0	0	0	0	6205539	1996	0		0	
1997	1	7442	158	624082	0	0	0	0	13437884	1997	0		0	
1997	2	7171	122	370238	0	0	0	0	7662161	1997	0		0	
1997	3	3617	44	84522	5	46	0.0000592	0.0005442	5182111	1997	307	38521.70	2820	3365381.38
1997	4	5419	60	165160	0	0	0	0	7285331	1997	0		0	
1998	1	7139	188	721302	0	0	0	0	11593825	1998	0		0	
1998	2	10044	171	445545	0	0	0	0	11095710	1998	0		0	
1998	3	6538	74	188650	0	0	0	0	4936105	1998	0		0	
1998	4	10459	201	389565	0	0	0	0	10364459	1998	0		0	
1999	1	9966	178	415409	0	0	0	0	15419441	1999	0		0	
1999	2	12978	165	258078	0	0	0	0	10703373	1999	0		0	
1999	3	6921	57	34398	0	0	0	0	4313068	1999	0		0	
1999	4	9960	141	151499	0	0	0	0	4797991	1999	0		0	
2000	1	9404	167	315222	0	0	0	0	10613819	2000	0		0	
2000	2	13972	128	169855	0	0	0	0	7561112	2000	0		0	
2000	3	8506	54	50335	0	0	0	0	5347853	2000	0		0	
2000	4	6584	179	213672	0	0	0	0	6218047	2000	0		0	
2001	1	4106	114	250449	0	0	0	0	5472383	2001	0		0	
2001	2	9685	321	425054	0	0	0	0	7643587	2001	0		0	
2001	3	6625	29	25998	0	0	0	0	4515072	2001	0		0	
2001	4	8196	138	188893	0	0	0	0	8359220	2001	0		0	
2002	1	3518	60	129338	0	0	0	0	6346260	2002	0		0	
2002	2	7229	103	162948	0	0	0	0	6573098	2002	0		0	
2002	3	7511	39	41320	0	0	0	0	4232936	2002	0		0	
2002	4	9725	102	113002	0	0	0	0	5813928	2002	0		0	
2003	1	4426	42	128509	0	0	0	0	6790982	2003	0		0	
2003	2	11792	85	165439	0	0	0	0	10075795	2003	0		0	
2003	3	6710	65	112425	1	5	0.0000089	0.0000445	4042000	2003	36	1294.12	180	32352.96
2003	4	9325	110	168057	1	12	0.0000060	0.0000714	7224862	2003	43	1818.39	516	261848.58
2004	1	2878	84	233932	0	0	0	0	8259297	2004	0		0	
2004	2	5269	199	285877	0	0	0	0	5988588	2004	0		0	
2004	3	4309	97	113572	0	0	0	0	3848151	2004	0		0	
2004	4	7064	218	273249	0	0	0	0	4399535	2004	0		0	
2005	1	1604	118	283264	0	0	0	0	4921520	2005	0		0	
2005	2	6743	166	286338	0	0	0	0	7193762	2005	0		0	
2005	3	5108	115	132707	0	0	0	0	3982075	2005	0		0	
2005	4	5168	204	330316	0	0	0	0	4789633	2005	0		0	
2006	1	2651	121	306420	0	0	0	0	3818953	2006	0		0	
2006	2	6848	214	323676	0	0	0	0	4701491	2006	0		0	
2006	3	4267	122	154976	0	0	0	0	1995687	2006	0		0	
2006	4	5260	172	178552	0	0	0	0	3163917	2006	0		0	
2007	1	2901	170	392488	0	0	0	0	6026071	2007	0		0	
2007	2	7834	223	335202	0	0	0	0	7548332	2007	0		0	
2007	3	5574	126	126277	0	0	0	0	4417444	2007	0		0	
2007	4	7899	177	217616	0	0	0	0	7256495	2007	0		0	

Appendix 1. Table 3. Smooth hammerhead live discard ratios & estimated quarterly discards

year	qtr	total OBS		OBS total catch kept	numbers		weight		total catch kept	est number			est weight	
		trips	trips		live disc	live disc	live d/k	live d/k		year	live disc	variance	live disc	variance
2008	1	2191	85	170841	0	0	0	0	3976648	2008	0		0	
2008	2	7015	148	237764	0	0	0	0	7460250	2008	0		0	
2008	3	3338	76	82256	9	115	0.0001094	0.0013981	3689063	2008	404	32093.77	5158	7180201.14
2008	4	5098	161	202308	2	13	0.0000099	0.0000643	5542941	2008	55	1455.74	356	64847.42
2009	1	2892	76	160875	0	0	0	0	6917752	2009	0		0	
2009	2	7799	132	283343	0	0	0	0	8787736	2009	0		0	
2009	3	5642	72	55119	0	0	0	0	4808684	2009	0		0	
2009	4	6043	119	184534	0	0	0	0	6792093	2009	0		0	
2010	1	1809	64	123383	3	14.2	0.0000243	0.0001151	1720222	2010	42	747.15	198	15850.73
2010	2	7297	155	381766	0	0	0	0	6771064	2010	0		0	
2010	3	4987	68	56011	0	0	0	0	2469085	2010	0		0	
2010	4	5409	172	290034	0	0	0	0	3704102	2010	0		0	
2011	1	3723	78	169470	0	0	0	0	7495344	2011	0		0	
2011	2	8850	75	175553	0	0	0	0	8575632	2011	0		0	
2011	3	6031	39	47146	0	0	0	0	5147161	2011	0		0	
2011	4	8313	108	282300	1	3.8	0.0000035	0.0000135	9077323	2011	32	1029.95	122	14872.51
2012	1	4062	129	273619	2	80	0.0000073	0.0002924	6380538	2012	47	515.44	1866	3347242.51
2012	2	9197	93	361257	0	0	0	0	8733780	2012	0		0	
2012	3	5715	34	37813	0	0	0	0	3447968	2012	0		0	
2012	4	7174	53	78464	0	0	0	0	6396726	2012	0		0	
2013	1	4006	70	170770.66	0	0	0	0	5370857	2013	0		0	
2013	2	7481	70	186467.93	0	0	0	0	8518949	2013	0		0	
2013	3	4638	101	107371	1	2.3	0.0000093	0.0000214	3288687	2013	31	926.00	70	5931962.53
2013	4	6122	128	242393.695	1	45	0.0000041	0.0001856	6383728	2013	26	675.14	1185	4346878.16
2014	1	2763	146	504205.192	1	100	0.0000020	0.0001983	6893432	2014	14	178.23	1367	1782319.96
2014	2	8256	127	375519.2555	0	0	0	0	11444388	2014	0		0	
2014	3	4951	71	77747.2512	0	0	0	0	4801730	2014	0		0	
2014	4	6931	143	449828.8456	0	0	0	0	8442919	2014	0		0	
2015	1	3154	121	470617.57	0	0	0	0	6620887	2015	0		0	
2015	2	7038	164	413372.3317	3	12.1	0.0000073	0.0000293	9505474	2015	69	2591.98	278	68786.25
2015	3	4964	125	154866.7506	0	0	0	0	3747031	2015	0		0	
2015	4	6108	217	642034.4215	0	0	0	0	6883195	2015	0		0	
2016	1	3539	259	974205.5605	0	0	0	0	6131022	2016	0		0	
2016	2	6456	283	738564.5565	2	110	0.0000027	0.0001489	6416448	2016	17	287.96	956	871088.35
2016	3	3017	188	193026.6	2	97.1	0.0000104	0.0005030	855439	2016	9	73.42	430	173060.45
2016	4	6038	345	860626.9847	0	0	0	0	5868787	2016	0		0	
2017	1	4050	267	736144.0501	0	0	0	0	5456725	2017	0		0	
2017	2	5724	275	779956.6669	2	38	0.0000026	0.0000487	6275152	2017	16	246.39	306	88945.07
2017	3	2936	226	199751.1501	0	0	0	0	1262255	2017	0		0	
2017	4	5596	287	669476.4223	0	0	0	0	5015029	2017	0		0	
2018	1	2871	114	504628.85	1	7	0.0000020	0.0000139	3436693	2018	7	44.21	48	2166.31
2018	2	5879	216	481377.2192	0	0	0	0	6173146	2018	0		0	
2018	3	3154	139	93444.63234	0	0	0	0	1112750	2018	0		0	
2018	4	5019	238	729856.8231	0	0	0	0	5378083	2018	0		0	
2019	1	5012	284	989919.9613	1	100	0.0000010	0.0001010	5306652	2019	5	27.20	536	271985.60
2019	2	6881	278	867758.1415	2	56	0.0000023	0.0000645	5696343	2019	13	82.32	368	104575.63
2019	3	4024	123	141688.9503	0	0	0	0	1106358	2019	0		0	
2019	4	5036	259	969160.312	0	0	0	0	6392944	2019	0		0	
				1995 - 2019 AVERAGE			0.0000027	0.0000386						

Appendix 1. Table 4. Smooth hammerhead dead discard ratios and estimated quarterly discards.

year	qtr	total trips	OBS trips	OBS total catch	total numbers dead	total weight disc	total numbers dead d/k	total weight dead d/k	total catch kept	est number year	est number dead disc	est number variance	est weight dead disc	est weight variance
1995	1	4246	168	696215	0	0	0	0	3033632	1995	0		0	
1995	2	6903	107	263272	0	0	0	0	7683314	1995	0		0	
1995	3	1995	57	81148	0	0	0	0	3281504	1995	0		0	
1995	4	4645	104	242037	0	0	0	0	4576353	1995	0		0	
1996	1	3918	147	745069	0	0	0	0	6680287	1996	0		0	
1996	2	6081	92	269840	0	0	0	0	9506248	1996	0		0	
1996	3	1744	51	69453	0	0	0	0	3621887	1996	0		0	
1996	4	4206	75	200042	0	0	0	0	6205539	1996	0		0	
1997	1	7442	158	624082	1	300	0.0000016	0.0004807	13437884	1997	22	456.45	6460	41080297.73
1997	2	7171	122	370238	0	0	0	0	7662161	1997	0		0	
1997	3	3617	44	84522	9	28	0.0001065	0.0003313	5182111	1997	552	227780.36	1717	2066505.15
1997	4	5419	60	165160	0	0	0	0	7285331	1997	0		0	
1998	1	7139	188	721302	0	0	0	0	11593825	1998	0		0	
1998	2	10044	171	445545	0	0	0	0	11095710	1998	0		0	
1998	3	6538	74	188650	0	0	0	0	4936105	1998	0		0	
1998	4	10459	201	389565	0	0	0	0	10364459	1998	0		0	
1999	1	9966	178	415409	0	0	0	0	15419441	1999	0		0	
1999	2	12978	165	258078	0	0	0	0	10703373	1999	0		0	
1999	3	6921	57	34398	0	0	0	0	4313068	1999	0		0	
1999	4	9960	141	151499	0	0	0	0	4797991	1999	0		0	
2000	1	9404	167	315222	0	0	0	0	10613819	2000	0		0	
2000	2	13972	128	169855	0	0	0	0	7561112	2000	0		0	
2000	3	8506	54	50335	0	0	0	0	5347853	2000	0		0	
2000	4	6584	179	213672	0	0	0	0	6218047	2000	0		0	
2001	1	4106	114	250449	0	0	0	0	5472383	2001	0		0	
2001	2	9685	321	425054	0	0	0	0	7643587	2001	0		0	
2001	3	6625	29	25998	0	0	0	0	4515072	2001	0		0	
2001	4	8196	138	188893	0	0	0	0	8359220	2001	0		0	
2002	1	3518	60	129338	0	0	0	0	6346260	2002	0		0	
2002	2	7229	103	162948	0	0	0	0	6573098	2002	0		0	
2002	3	7511	39	41320	0	0	0	0	4232936	2002	0		0	
2002	4	9725	102	113002	0	0	0	0	5813928	2002	0		0	
2003	1	4426	42	128509	0	0	0	0	6790982	2003	0		0	
2003	2	11792	85	165439	0	0	0	0	10075795	2003	0		0	
2003	3	6710	65	112425	0	0	0	0	4042000	2003	0		0	
2003	4	9325	110	168057	0	0	0	0	7224862	2003	0		0	
2004	1	2878	84	233932	0	0	0	0	8259297	2004	0		0	
2004	2	5269	199	285877	0	0	0	0	5988588	2004	0		0	
2004	3	4309	97	113572	0	0	0	0	3848151	2004	0		0	
2004	4	7064	218	273249	0	0	0	0	4399535	2004	0		0	
2005	1	1604	118	283264	0	0	0	0	4921520	2005	0		0	
2005	2	6743	166	286338	0	0	0	0	7193762	2005	0		0	
2005	3	5108	115	132707	0	0	0	0	3982075	2005	0		0	
2005	4	5168	204	330316	1	7	0.0000030	0.0000212	4789633	2005	15	202.66	102	9930.19
2006	1	2651	121	306420	0	0	0	0	3818953	2006	0		0	
2006	2	6848	214	323676	1	5	0.0000031	0.0000154	4701491	2006	15	205.09	73	5127.24
2006	3	4267	122	154976	1	4	0.0000065	0.0000258	1995687	2006	13	161.44	52	2582.99
2006	4	5260	172	178552	0	0	0	0	3163917	2006	0		0	
2007	1	2901	170	392488	0	0	0	0	6026071	2007	0		0	
2007	2	7834	223	335202	0	0	0	0	7548332	2007	0		0	
2007	3	5574	126	126277	6	9	0.0000475	0.0000713	4417444	2007	210	43374.90	315	97593.53
2007	4	7899	177	217616	0	0	0	0	7256495	2007	0		0	

Appendix 1. Table 4. Smooth hammerhead dead discard ratios and estimated quarterly discards.

year	qtr	total OBS		OBS total		numbers weight		numbers weight		total		est number		est weight					
		trips	trips	catch	kept	dead	disc	dead	disc	dead	d/k	catch	kept	year	dead	disc	variance	dead	disc
2008	1	2191	85	170841		0	0	0	0	3976648		2008	0			0			
2008	2	7015	148	237764		0	0	0	0	7460250		2008	0			0			
2008	3	3338	76	82256		11	70.6	0.0001337	0.0008583	3689063		2008	493	111312.27		3166		6456133.66	
2008	4	5098	161	202308		3	22	0.0000148	0.0001087	5542941		2008	82	6578.86		603		353796.37	
2009	1	2892	76	160875		0	0	0	0	6917752		2009	0			0			
2009	2	7799	132	283343		0	0	0	0	8787736		2009	0			0			
2009	3	5642	72	55119		0	0	0	0	4808684		2009	0			0			
2009	4	6043	119	184534		0	0	0	0	6792093		2009	0			0			
2010	1	1809	64	123383		14	1646.3	0.0001135	0.0133430	1720222		2010	195	6251.49		22953		428194899.24	
2010	2	7297	155	381766		0	0	0	0	6771064		2010	0			0			
2010	3	4987	68	56011		0	0	0	0	2469085		2010	0			0			
2010	4	5409	172	290034		1	30	0.0000034	0.0001034	3704102		2010	13	1428.36		383		76610.51	
2011	1	3723	78	169470		0	0	0	0	7495344		2011	0			0			
2011	2	8850	75	175553		0	0	0	0	8575632		2011	0			0			
2011	3	6031	39	47146		0	0	0	0	5147161		2011	0			0			
2011	4	8313	108	282300		0	0	0	0	9077323		2011	0			0			
2012	1	4062	129	273619		0	0	0	0	6380538		2012	0			0			
2012	2	9197	93	361257		0	0	0	0	8733780		2012	0			0			
2012	3	5715	34	37813		0	0	0	0	3447968		2012	0			0			
2012	4	7174	53	78464		0	0	0	0	6396726		2012	0			0			
2013	1	4006	70	170770.66		0	0	0	0	5370857		2013	0			0			
2013	2	7481	70	186467.93		0	0	0	0	8518949		2013	0			0			
2013	3	4638	101	107371		0	0	0	0	3288687		2013	0			0			
2013	4	6122	128	242393.69		0	0	0	0	6383728		2013	0			0			
2014	1	2763	146	504205.19		1	35	0.0000020	0.0000694	6893432		2014	14	174.70		479		214004.86	
2014	2	8256	127	375519.26		1	18.5	0.0000027	0.0000493	11444388		2014	30	911.23		564		311867.78	
2014	3	4951	71	77747.251		2	6	0.0000257	0.0000772	4801730		2014	124	7680191.63		371		135929.72	
2014	4	6931	143	449828.85		0	0	0	0	8442919		2014	0			0			
2015	1	3154	121	470617.57		1	180	0.0000021	0.0003825	6620887		2015	14	191.38		2532		6200778.23	
2015	2	7038	164	413372.33		2	11.5	0.0000048	0.0000278	9505474		2015	46	1031.19		264		34663.30	
2015	3	4964	125	154866.75		0	0	0	0	3747031		2015	0			0			
2015	4	6108	217	642034.42		0	0	0	0	6883195		2015	0			0			
2016	1	3539	259	974205.56		0	0	0	0	6131022		2016	0			0			
2016	2	6456	283	738564.56		2	83.8	0.0000027	0.0001135	6416448		2016	17	287.96		728		505550.88	
2016	3	3017	188	193026.6		2	64.5	0.0000104	0.0003342	855439		2016	9	35.48		286		25709.11	
2016	4	6038	345	860626.98		0	0	0	0	5868787		2016	0			0			
2017	1	4050	267	736144.05		1	4.1	0.0000014	0.0000056	5456725		2017	7	51.26		30		861.73	
2017	2	5724	275	779956.67		1	26	0.0000013	0.0000333	6275152		2017	8	61.60		209		41639.10	
2017	3	2936	226	199751.15		1	1.2	0.0000050	0.0000060	1262255		2017	6	37.00		8		53.28	
2017	4	5596	287	669476.42		0	0	0	0	5015029		2017	0			0			
2018	1	2871	114	504628.85		0	0	0	0	3436693		2018	0			0			
2018	2	5879	216	481377.22		0	0	0	0	6173146		2018	0			0			
2018	3	3154	139	93444.632		2	215	0.0000214	0.0023008	1112750		2018	24	265.35		2560		4308796.41	
2018	4	5019	238	729856.82		0	0	0	0	5378083		2018	0			0			
2019	1	5012	284	989919.96		0	0	0	0	5306652		2019	0			0			
2019	2	6881	278	867758.14		0	0	0	0	5696343		2019	0			0			
2019	3	4024	123	141688.95		1	3	0.0000071	0.0000212	1106358		2019	8	58.80		23		529.23	
2019	4	5036	259	969160.31		0	0	0	0	6392944		2019	0			0			
						1995 - 2019 AVERAGE		0.0000052	0.0001878										